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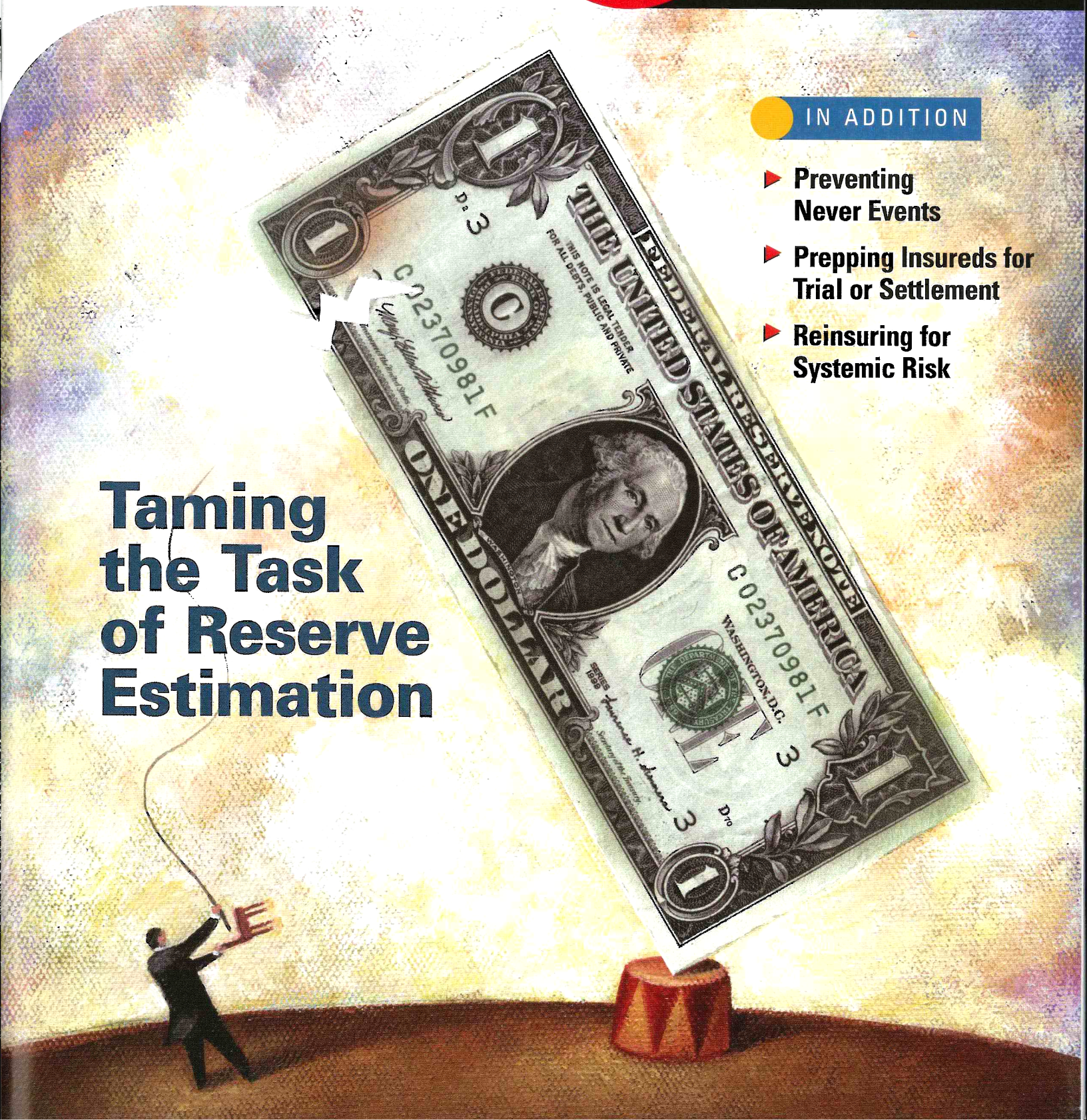


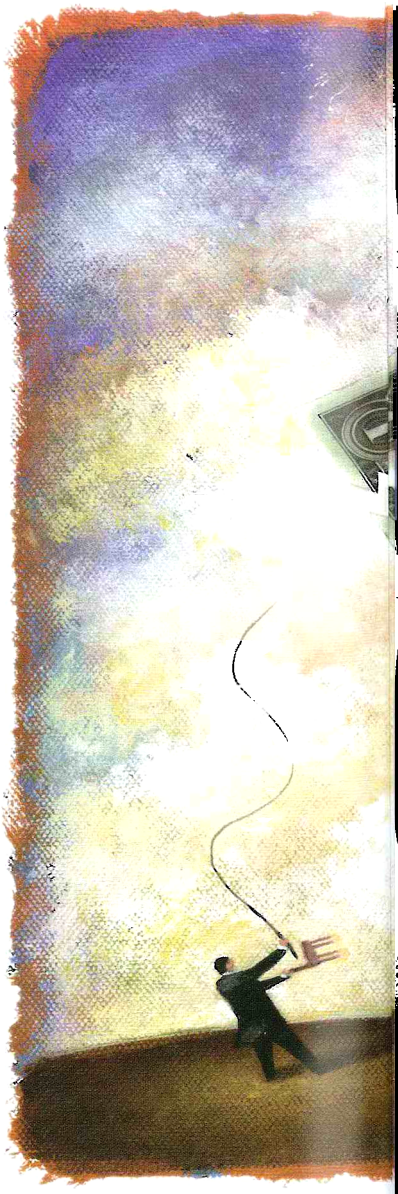
Taming the Task of Reserve Estimation

IN ADDITION

- Preventing Never Events
- Prepping Insureds for Trial or Settlement
- Reinsuring for Systemic Risk

COVER STORY

By Kevin J. Atinsky and Chad C. Karls



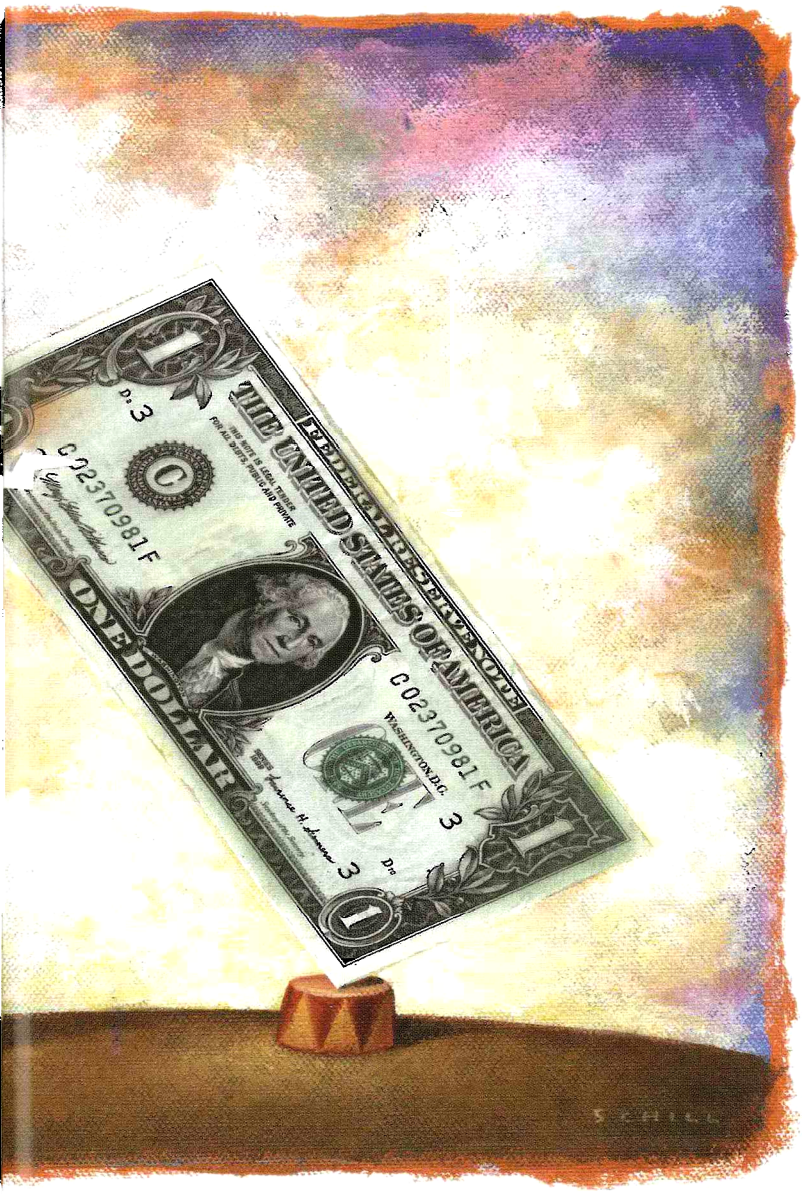
Understanding, Then Managing, Loss Reserve Volatility

EVERY INDUSTRY'S FINANCIAL STATEMENTS *involve some amount of uncertainty, typically on the asset side of the balance sheet. Whether it be the value of inventory, work in progress, or potential write-offs relating to accounts receivable or non-performing mortgage loans, the final balance sheet and resultant income statement are impacted by estimates.*

The uncertainty involved in a company's balance sheet is particularly pronounced within the insurance industry, especially for those companies whose business is concentrated in long-tail liability lines of business. Here, the uncertainty stems not from the asset side of the balance sheet, but rather from a company's liabilities, and in particular, the value carried on account of the company's loss and loss adjustment expense reserves (loss reserves).

Not only is the loss reserve typically the most uncertain component of a property and casualty insurance company's balance sheet, it is also frequently the largest component. This is true for most medical

Kevin J. Atinsky, FCAS, MAAA, *manages the Chicago team of Aon Global Risk Consulting, Actuarial and Analytics Practice. kevin_atinsky@aon.com.* ***Chad C. Karls, FCAS, MAAA,*** *is a Principal and Consulting Actuary at the Milwaukee office of Milliman, Inc. chad.karls@milliman.com.*



professional liability (MPL) specialty insurance companies. As potential metrics for assessing the importance and influence of a company's loss reserves on its financial performance and solvency, consider two reserve-based leverage ratios: reserves to premium and reserves to surplus.

The reserve to premium ratio offers insight into how significantly a company's earnings could be impacted by a revaluation of its loss reserves. This reserve to premium leverage ratio for a Milliman-created composite of 50 MPL specialty insurance companies, as of year end 2006, was approximately 2.75 to 1.00. In other words, for every dollar of premium earned by these companies during 2006, there was $2.75 of loss reserves on their collective balance sheet as of December 31, 2006. Thus, a relatively moderate 5% revaluation of the balance sheet component with the most uncertainty— the loss reserves—would have an approximate 14-point impact on the industry's pre-tax operating margins (5% x 2.75 = 14 points of revenue). For reference, a 5% revaluation of an MPL specialty company's loss reserves is not unprecedented.

The same type of analysis and comparison can be done using the reserve to surplus ratio. Again, in referencing the same 50-company composite of MPL specialty insurance companies, for every dollar of surplus the companies reported as of year end 2006, there was approximately $2.10 of loss reserves on their collective balance sheet. Thus, just as a 5% revaluation of the loss reserves would significantly impact the operating results (by 14 points); so too, it would simultaneously and significantly impact the industry's solvency by reducing surplus by approximately 11%, all else equal.

The leverage ratios cited above were derived by referencing the aggregate financial statements from our 50-company MPL composite. Of course, what is more important than the leverage associated with an aggregate composite are the individual company ratios underlying this composite. When reviewing the leverage ratios for the 50 companies individually, we found the distributions for the ratios that are shown in Figure 1 and Figure 2.

Even though the aggregate leverage ratios are relatively modest when compared to historical levels, over a quarter of the companies have a reserve to premium ratio in excess of 3.0 to 1.0. Turning our attention to the reserve to surplus ratio, nearly 20% of the companies have a reserve to surplus ratio greater than 2.5 to 1.0. Figure 1 and Figure 2 display the results of these ratios independently. Of note is that 10% of the companies have *both* a reserve to premium ratio in excess of 3.0 to 1.0 and a reserve to surplus ratio in excess of 2.5 to 1.0.

Refined approach to estimating ranges

As demonstrated above, the adequacy of a company's loss reserves is important in measuring the operating performance of a company, as well as in assessing its capitalization levels. Thus, it should come as no surprise that most companies spend a great deal of time and effort in reviewing and continually monitoring the adequacy of their loss reserves. Further, the regulatory framework under which insurance companies operate also places a great deal of emphasis on a company's loss reserves, including requiring insurance companies to obtain a Statement of Actuarial Opinion from a qualified professional. Finally, the results of the capital adequacy models used by the rating agencies are largely driven by the value of the loss reserves, as well as the assumptions employed regarding the adequacy of those reserves.

"The actual development, as compared to the expected development, is "skewed to the right."

Figure 1 Medical Professional Liability Specialty Writers Reserve to Premium Ratio

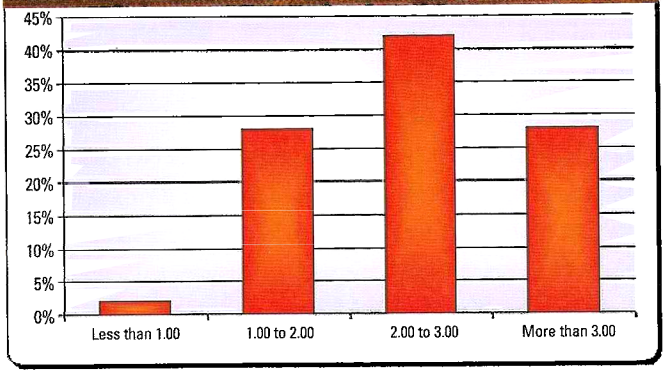
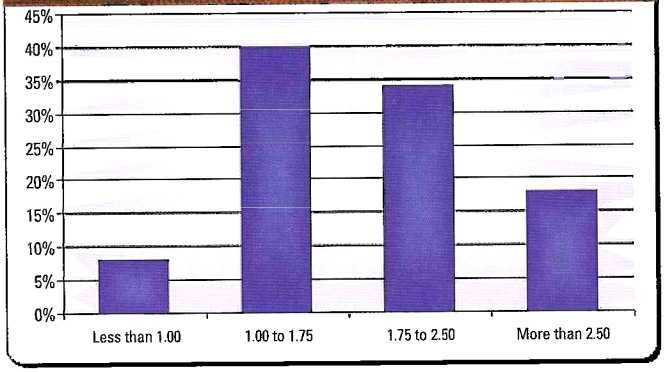


Figure 2 Medical Professional Liability Specialty Writers Reserve to Surplus Ratio



With many constituents interested in loss reserve adequacy, along with the ongoing advancements in actuarial science and computer processing capabilities, there has been some recent additional momentum toward using simulation-based statistical analysis of a company's historical data to gain additional information regarding the uncertainty inherent in the loss reserves. Generally speaking, up to this point most actuarial analyses have resulted in a single estimate of a company's loss reserves. Occasionally, this single-point estimate for the loss reserve has been supplemented with a "reasonable range" around the point estimate.

The most common approach in generating a reasonable range is to use various combinations of the underlying deterministic methods along with, perhaps, alternative underlying assumptions within those methods. The advantage of constructing a range in this manner is that the result is wholly consistent with the previously determined point estimate. The disadvantage to this approach is that one is not able to generate any additional statistical information (i.e., mean, median, n^{th} percentile, etc.) concerning the variability inherent in the company's loss reserves.

One approach in trying to tease out of the loss reserving data more statistical information is through a process known as *"bootstrapping."* Bootstrapping was originally created by statisticians and is not new, nor unique to insurance. It is a statistical model that relies on resampling the possible avenues the data could have taken by referencing the random nature of the path the data actually took. Within traditional property and casualty actuarial analyses, this can be thought of as randomly generating thousands (or, more realistically, tens of thousands) of loss development triangles and turning each one of them into a square, by projecting the ultimate loss and then unpaid loss (i.e., loss reserves). With these thousands of outcomes having been produced, one can then rank the loss reserves that result from each iteration of this process and gain a sense of the overall distribution of loss reserves that are possible[1]. In addition to developing a sense for the overall uncertainty associated with a company's loss reserves, one can also use the results of such a model for the following:

Bootstrapping

- Estimate the probability distribution of loss reserves
- Evaluate the capital requirements needed to support the company's reserve risk and compare these values to those utilized by regulators and rating agencies
- Evaluate the capital requirements needed to support the company's pricing risk and compare these values to those utilized by regulators and rating agencies
- Allocate capital to business segments consistent with the inherent volatility of each
- Exploit the benefits associated with diversification
- Manage the risks that come with concentration.

Case Study: Distribution of Reserves

The remainder of this article will present the results of a case study in which we applied this process to a PIAA member company. For purposes of disguising the company and its actual data, we have multiplied all of the values presented by a fixed number that changes the absolute value of the numbers presented herein but not the relationship between them, and therefore maintains the validity of the probability results and hence the approach to estimating a distribution of loss reserves.

In reviewing the subject company's historical paid and incurred data, we observed a tendency for the actual development, as compared to the expected development, to be "skewed to the right," where expected development is defined here as average development. Said in true actuarial parlance, the worse than expected development was *"more worse"* than what the better-than-expected development was *"more better."* This is a common observation when reviewing insurance datasets, particularly the low-frequency, high-severity lines of business such as MPL. This tendency results from there being a limit as to how

good a claim can get (i.e., a $0 payment), whereas there is a much larger potential for a claim to get worse (i.e., a multi-million dollar payment). The skewness associated with this individual-claim example is then replicated over the company's entire claims inventory and results in a "skewed to the right" aggregate distribution of losses[2]

This expectation of having a skewed to the right distribution of unpaid claim liabilities was in fact consistent with our findings in our analysis of the PIAA company's loss reserves. In reviewing the distribution, we noted a greater number of possible outcomes on the right side of the highest point of the distribution, which results in the expected value (i.e , mean) of this distribution being greater than the most-likely point of the distribution (i.e., mode).

In addition to observing the overall distribution of losses, one can also assess the company's capital requirements, with regard to its loss reserves. In order to do so, one would need to define in more detail what is meant by a company's "capital requirements." One definition might be that the company wants to maintain its capital at such a level that there is less than an x% chance that the company would become insolvent on account of its loss reserves, all else equal. Using the results of our analysis and assuming x is set equal to 0.5% and the company's carried reserves are $270 million, Figure 3 indicates that our subject company would need capital of approximately $97 million in order to satisfy its capital requirements.

While the analysis described above relies on certain simplifying assumptions in deriving the required capital amount, we believe it is a reasonable and objective approach to a better definition and analysis of a company's capitalization in relation to its single largest risk factor, that being loss reserve adequacy. Although outside the scope of this article, another byproduct of this type of analysis is that one can also begin to understand (arguably) its second largest risk factor as well, its pricing risk, by quantifying the volatility inherent in its ultimate loss ratios across years.

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In the end, there will always be the need to employ professional judgment in interpreting a company's data as well as the impact from broader industry trends and changes in the tort environment. However, we believe it is also instructive to review, with somewhat more statistical rigor than has been done in the past, the underlying volatility in a company's history in an effort to better manage one's business. PIAA

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Footnotes

[1] Theoretically, this process could result in "all" possible outcomes but, since one is reliant only on the actual data to date, the resulting distribution should be thought of as an estimate of "reasonable" values, as opposed to "all" values. The actual calculations underlying this process are significantly more complicated than that described herein, and outside the scope of this article.

[2] This skewness is tempered somewhat by the law of large numbers, since it is not likely that all claims will develop adversely at the same time.

Figure 3 Case Study: Capital Requirements